Photovoltaics

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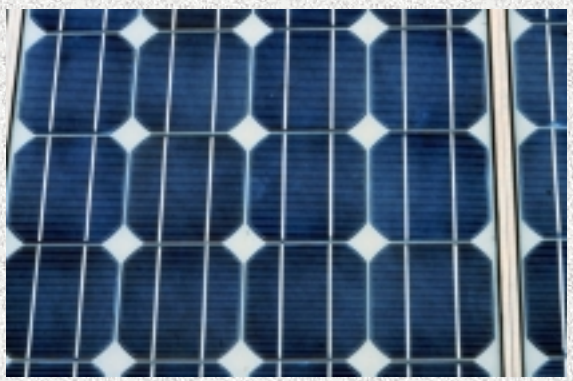
Photovoltaics (PV) or Solar Electricity

- PV is the direct conversion of sunlight to DC electricity using a semiconductor effect—there are no moving parts.
- PV cells—the basic building blocks of a PV system—are made from either silicon (crystalline, polycrystalline, and amorphous), cadmium-tellurium, or alloys of copper indium diselenide.
- Crystalline- and polycrystalline-silicon modules are the most common worldwide, followed by amorphous silicon. Cadmium tellurium and copper indium diselenide modules are being introduced to the market.
- PV cells are interconnected to increase the output voltage and current. PV cells are packaged inside a module to protect the cells from water, humidity, and physical damage and for electrical safety.

Crystalline-silicon PV cell.



PV cells are series-interconnected in a PV module.

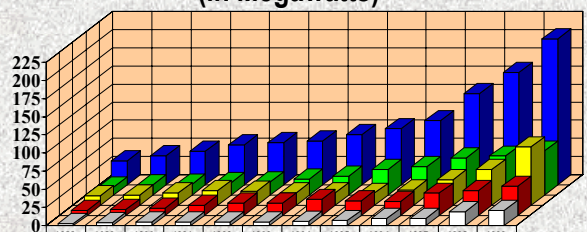
PV Modules Are Reliable

- International standards for power ratings and reliability.
- Many companies offer 10–20 year warranties.
- Can be mounted on the ground, on roofs, on poles, or on floats on lakes.
- Can be interconnected for higher voltages or currents. (Most modules are made for charging a 12-volt lead-acid battery.)
- Can power DC equipment or AC equipment (with an inverter).
- Can be used in hybrid systems with wind turbines or generators.

PV Economics

- Module prices are US$4.50–$6.00/W for all PV technologies. Prices in other countries will depend on quantity, available supply, taxes, tariffs, and shipping.
- The solar resource and electrical loads are the primary factors in determining the size, and hence cost, of a PV system. Reducing electrical loads will result in less costly PV systems.
- International reliability standards include testing for wind loading, hail impact, thermal cycling, and electrical isolation. Modules that meet the standards will last longer in the field, resulting in a lower system life-cycle cost.

World PV Module Shipments (1988–1999) (in Megawatts)



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Rest of World	3	4	4.7	5	4.6	4.4	5.6	6.35	9.75	9.4	18.7	20.5
Europe	6.7	7.9	10.2	13.4	16.4	16.55	21.7	20.1	18.8	30.4	33.5	40
Japan	12.8	14.2	16.8	19.9	18.8	16.7	16.5	16.4	21.2	35	49	80
United States	11.1	14.1	14.8	17.1	18.1	22.44	25.64	34.75	38.85	51	53.7	60.8
Total	33.6	40.2	46.5	55.4	57.9	60.09	69.44	77.6	88.6	125.8	154.9	201.3

PV modules generally range in size from 50 W to120 W and can be installed by one or two people. Several modules can be interconnected for more power.